

CLAIMS

What is claimed is:

1. A catheter, comprising: an elongated catheter shaft; an optical fiber, extending through the catheter shaft, for transmitting light to tissue located at a distal end of the catheter shaft; an optical fiber, extending through the catheter shaft, for conveying light back from the tissue for analysis by a spectroscopic diagnosis system to determine whether an interventional procedure should be performed on the tissue; and an interventional device located at the distal end of the catheter shaft for engaging tissue diagnosed by the spectroscopic diagnosis system in order to perform the interventional procedure on the tissue.
2. The catheter of claim 1, wherein the optical fiber for transmitting light to tissue is distinct from the optical fiber for conveying light back from the tissue.
3. The catheter of claim 1, wherein the interventional device comprises a scalpel.
4. The catheter of claim 1, wherein the interventional device comprises forceps jaws.
5. The catheter of claim 1, wherein the interventional device comprises a snare.
6. The catheter of claim 1, wherein the interventional device comprises a scissors.
7. The catheter of claim 1, wherein the interventional device comprises a needle.
8. The catheter of claim 7, wherein the needle is constructed to inject a marking fluid into the tissue.
9. The catheter of claim 7, wherein the needle is constructed to inject a chemical ablation fluid into the tissue.

10. The catheter of claim 7, wherein the needle is constructed to cut the tissue.
11. The catheter of claim 7, wherein the needle is constructed to apply an adhesive material to the tissue.
12. The catheter of claim 7, wherein the needle is constructed to convey a fluid to the tissue useful for enabling visual observation of the tissue.
13. The catheter of claim 7, wherein the needle is constructed to apply a vacuum to the tissue.
14. The catheter of claim 11, wherein the catheter shaft is constructed to be inserted through a working channel of an endoscope.
15. The catheter of claim 1, wherein at least one of the optical fibers is further constructed for conveying visualization light to the tissue.
16. The catheter of claim 1, wherein at least one of the optical fibers is further constructed for conveying light back from the tissue for visual observation of the tissue.
17. A method of diagnosing and performing an interventional procedure on tissue, comprising the steps of: inserting into a lumen of a body of a living being a catheter having a first optical fiber for transmitting light to tissue located at a distal end of the catheter, a second optical fiber for conveying light back from the tissue for analysis by a spectroscopic diagnosis system, and an interventional device; transmitting light through the first optical fiber to tissue located at a distal end of the catheter; conveying light back from the tissue through the second optical fiber for analysis by a spectroscopic diagnosis system; diagnosing the tissue with the spectroscopic diagnosis system to determine whether an interventional procedure should be performed on the tissue; and engaging, with the interventional device, the tissue diagnosed by the spectroscopic diagnosis system in order to perform the interventional procedure on the tissue.
18. The method of claim 17, wherein the interventional procedure comprises marking the tissue by

injecting a marking fluid into the tissue with the interventional device.

19. The method of claim 18, wherein the marking fluid is india ink.

20. The method of claim 18, further comprising the steps of:  
withdrawing the catheter having the optical fibers and the interventional device; inserting into the body of the living being a second catheter having a second interventional device located at its distal end; and engaging, with the second interventional device of the second catheter, the tissue diagnosed by the spectroscopic diagnosis system in order to perform another interventional procedure on the tissue.

21. The method of claim 17, wherein the step of diagnosing the tissue using the spectroscopic diagnosis system comprises determining whether an interventional procedure should be performed on the tissue.

22. The method of claim 17, wherein the interventional procedure comprises removing tissue for biopsy analysis.

23. The method of claim 17, wherein the interventional procedure comprises removing tissue diagnosed by the spectroscopic diagnosis system as being unhealthy.

24. The method of claim 17, wherein the lumen comprises an alimentary lumen.

25. The method of claim 17, wherein the lumen comprises a pulmonary lumen.

26. The method of claim 17, wherein the step of diagnosing the tissue further comprises determining whether the tissue is a tumor.

27. The method of claim 26, wherein the step of diagnosing the tissue further comprises determining whether the tumor is cancerous.

28. The method of claim 17, further comprising the step of inserting through the lumen of the body of

the living being an endoscope having a working channel, and wherein the step of inserting the catheter into the body of the living being comprises inserting the catheter into the working channel of the endoscope.

29. The method of claim 17, further comprising the step of conveying visualization light to the tissue through at least one of the optical fibers.

30. The method of claim 17, further comprising the step of conveying light back from the tissue through at least one of the optical fibers for visual observation of the tissue.

31. The method of claim 17, further comprising the step of conveying a fluid through the catheter shaft to the tissue useful for enabling visual observation of the tissue.

32. The method of claim 17, further comprising the step of applying a vacuum to the tissue through the catheter shaft.

33. An assembly comprising:

an endoscope;

an elongated catheter shaft constructed to be inserted through a working channel of the endoscope;

an optical fiber, extending through the catheter shaft, for transmitting light to tissue located at a distal end of the catheter shaft;

an optical fiber, extending through the catheter shaft, for conveying light back from the tissue for analysis by a spectroscopic diagnosis system to determine whether an interventional procedure should be performed on the tissue; and

an interventional device, constructed to be inserted through a working channel of the endoscope, for engaging tissue diagnosed by the spectroscopic diagnosis system in order to perform the interventional procedure on the tissue.

34. The assembly of claim 33 wherein the interventional device is located at the distal end of the catheter shaft having the optical fibers.

35. A method of diagnosing and performing an interventional procedure on tissue, comprising the steps of: inserting an endoscope through a lumen of a body of a living being; inserting through a working channel of the endoscope a catheter having a first optical fiber for transmitting light to tissue located at a distal end of the catheter and a second optical fiber for conveying light back from the tissue for analysis by a spectroscopic diagnosis system; transmitting light through the first optical fiber to tissue located at a distal end of the catheter; conveying light back from the tissue through the second optical fiber for analysis by a spectroscopic diagnosis system; diagnosing the tissue with the spectroscopic diagnosis system to determine whether an interventional procedure should be performed on the tissue; and engaging, with an interventional device inserted through a working channel of the endoscope, the tissue diagnosed by the spectroscopic diagnosis system in order to perform the interventional procedure on the tissue.

36. A method of imaging and performing an interventional procedure on tissue, comprising the steps of: inserting an endoscope through a lumen of a body of a living being;  
inserting through a working channel of the endoscope a catheter having an ultrasound imaging device located at its distal end;  
imaging a tissue structure located at a distal end of the endoscope with the ultrasound imaging device and displaying the tissue structure in a manner that indicates the depth of penetration of the tissue structure into the body of the living being; and  
engaging, with an interventional device inserted through a working channel of the endoscope, the tissue structure imaged by the ultrasound imaging device in order to perform interventional therapy on the tissue structure, the interventional therapy being performed in a manner responsive to the displayed depth of penetration of the tissue structure.

37. The method of claim 36, wherein the interventional device is located at the distal end of an interventional catheter distinct from the catheter having the ultrasound device, there are at least two working channels of the endoscope, and the catheter having the ultrasound device is inserted through a first of the two working channels and the interventional catheter is inserted through a second of the two working channels.

38. The method of claim 36, wherein the step of performing the interventional therapy in a manner

responsive to the displayed depth of penetration of the tissue structure comprises determining whether the depth of penetration of the tissue structure is sufficiently limited such that the interventional therapy is justifiable and then, if the depth of penetration is sufficiently limited, performing the interventional therapy.

39. The method of claim 36, wherein the step of performing the interventional therapy in a manner responsive to the displayed depth of penetration of the tissue structure comprises removing an amount of tissue corresponding to the depth of penetration.

40. The method of claim 39, wherein the imaging step is performed simultaneously with the step of performing the interventional therapy.

41. The method of claim 36, wherein the interventional device comprises a scalpel.

42. The method of claim 36, wherein the interventional device comprises forceps jaws.

43. The method of claim 36, wherein the interventional device comprises a snare.

44. The method of claim 36, wherein the interventional device comprises a scissors.

45. The method of claim 36, wherein the interventional device comprises a needle.

46. The method of claim 45, wherein the step of engaging the tissue structure with the interventional device comprises injecting a chemical ablation fluid into the tissue through the needle.

47. The method of claim 45, wherein the step of engaging the tissue structure with the interventional device comprises cutting the tissue with the needle.

48. The method of claim 45, wherein the step of engaging the tissue structure with the interventional device comprises applying an adhesive material to the tissue using the needle.

49. The method of claim 36, further comprising the step of transmitting light to the tissue structure, conveying light back from the tissue for analysis by a spectroscopic diagnosis system, and determining, using the spectroscopic diagnosis system, whether an interventional procedure should be performed on the tissue.

50. The method of claim 36, wherein the lumen comprises an alimentary lumen.

51. The method of claim 36, wherein the lumen comprises a pulmonary lumen.